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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,038	07/07/2006	Matthew Angyal	FIS920030180US1	5103

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EXAMINER	
KHATRI, PRASHANT J	

ART UNIT	PAPER NUMBER
1783	

NOTIFICATION DATE	DELIVERY MODE
07/12/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/597,038	ANGYAL ET AL.	
	Examiner	Art Unit	
	PRASHANT J. KHATRI	1783	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 April 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11 and 13-21* is/are pending in the application.

4a) Of the above claim(s) *18-21* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11 and 13-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

In response to Amendments/Arguments filed 4/6/2010. Claims 1-21 are pending. Claims 18-21 remain withdrawn.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-8, 10-11, 13 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatraman et al. (***WO 01/71776***) in view of Gates et al. (***US 20020093075***) with evidence from Ikeda et al. (***US 6407011***).

3. Venkatraman et al. disclose a low κ material having a variable dielectric constant throughout the thickness of the material. Concerning claims 1, 8, and 10-11, Venkatraman et al. disclose the material is disposed onto a substrate as a CVD precursor in which said material has a upper surface having a dielectric constant greater than 3.0 and a lower surface having a dielectric constant from about 2.1 to 2.7 (***pp. 5-6, lines 5+***). It is noted that at least one precursor is used and can be done by PECVD (***p. 5-6, lines 29+***). Given that the upper surface has a dielectric constant above 3.0 and the lower surface has a dielectric constant from about 2.1 to 2.7, the difference in dielectric constant between the upper and lower surface is from at least 0.3 to 0.9,

which would meet the present limitations of claims 4 and 5. Further, it is noted that the thickness of such a coating is from 50 angstroms to 10 microns (***p. 11, lines 30+***). Given the above disclosure regarding dielectric constants of the upper and lower surfaces in conjunction with the thicknesses above, it is clear that the disclosure of Venkatraman et al. would encompass and include the rate of decrease of κ presently claimed in claims 2 and 3. Regarding claim 17, it is noted that the above is used in semiconductor applications (***p. 5, lines 16+***). However, Venkatraman et al. are silent to a second region and profiles thereof.

4. Gates et al. disclose electronic structures with a reduced capacitance. Concerning claims 1 and 13, Gates et al. disclose a two layer graded laminate where in the second layer is disposed on the first layer (***claim 10***). The second layer is comprised of a profile wherein the carbon content increases with respect to the layer depth (i.e. from surface of the layer to the bottom of the layer) (***para. 0104-0107***). Examiner takes the position that with respect to the substrate, the second layer would produce a dielectric constant that increases from the bottom of the layer to the top. Further, it is noted that Ikeda et al. show the effects of carbon content with respect to the dielectric constant (***FIG. 2***). Regarding claims 6-7, it is noted that the dielectric profile is established with a linear and step-wise profile in regions. Further, the tailoring of such profiles to produce the desired dielectric and/or electrical properties is well-known within the art and considered to be obvious to one of ordinary skill in the art. As a result, the structure provides effective protection against air oxidation and barrier properties, high breakdown field, low leakage current and low dielectric constant (***para.***

0108-0109). While it is noted that Gates et al. disclose a two layer structure, it is noted that Venkatraman et al. disclose varying the thicknesses while also varying the dielectric constant. Given that Gates et al. discloses a profile wherein the dielectric constant varies from top to bottom to produce the above effects, it would have been obvious to one of ordinary skill in the art using the PECVD and/or CVD process as shown by Venkatraman to produce a region within the layer that incorporates the benefits of the above.

5. However, note that while Gates et al. do not disclose all the features of the present claimed invention, Gates et al. is used as teaching reference, and therefore, it is not necessary for this secondary reference to contain all the features of the presently claimed invention, *In re Nievelt*, 482 F.2d 965, 179 USPQ 224, 226 (CCPA 1973), *In re Keller* 624 F.2d 413, 208 USPQ 871, 881 (CCPA 1981). Rather this reference teaches a certain concept, namely, a second low κ material having a dielectric constant that increases with respect to the bottom of the material in order to improve electrical and barrier properties and in combination with the primary reference, discloses the presently claimed invention.

6. All of the elements were known within the art. The only difference is a single disclosure containing all of the presently claimed elements. Venkatraman et al. disclose the above; however, Venkatraman et al. are silent to a second dielectric region and profiles thereof. Gates et al. disclose electronic structures with a reduced capacitance comprising two dielectric layers having carbon content profiles. The motivation to combine the above references is drawn toward Gates et al. which disclose the resulting

structure provides effective protection against air oxidation and barrier properties, high breakdown field, low leakage current and low dielectric constant. Thus, it would have been obvious to one of ordinary skill in the art to apply a second profile that would improve the above properties.

7. Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatraman et al. (***WO 01/71776***) in view of Gates et al. (***US 20020093075***) with evidence from Ikeda et al. (***US 6407011***) as applied to claim 1 above, and further in view of Conti et al. (***US 6570256***).

1. Venkatraman et al. , Gates et al., and Ikeda et al. disclose the above; however, Venkatraman et al. , Gates et al., and Ikeda et al. are silent to a third region having a dielectric constant that decreases from the bottom to the top.

2. Conti et al. disclose a carbon graded layer wherein the carbon content increases from the bottom to the top (***abstract***). As evidenced by Ikeda et al., as the carbon content increases, the dielectric constant decreases (***FIG. 2***). The resultant structure reduces delamination by improving adhesion (***col. 3, lines 34+; col. 4, lines 6+***).

3. However, note that while Conti et al. do not disclose all the features of the present claimed invention, Conti et al. is used as teaching reference, and therefore, it is not necessary for this secondary reference to contain all the features of the presently claimed invention, *In re Nievelt*, 482 F.2d 965, 179 USPQ 224, 226 (CCPA 1973), *In re Keller* 624 F.2d 413, 208 USPQ 871, 881 (CCPA 1981). Rather this reference teaches a certain concept, namely, a profile that has increasing carbon content in order to improve

adhesion properties of the laminate and in combination with the primary reference, discloses the presently claimed invention.

8. All of the elements were known within the art. The only difference is a single disclosure containing all of the presently claimed elements. Venkatraman et al. disclose the above; however, Venkatraman et al., Gates et al., and Ikeda et al. are silent to a third region having a dielectric constant that decreases from the bottom to the top. Conti et al. disclose a carbon graded layer wherein the carbon content increases from the bottom to the top. The motivation to combine the above references is drawn towards Conti et al. which disclose that such a layer having the variable carbon content allows one of ordinary skill in the art to improve adhesion properties. Thus, it would have been obvious to one of ordinary skill in the art, with the impetus of improving adhesion properties, to provide a layer a profile having a dielectric constant that decreases from the bottom to the top.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatraman et al. (***WO 01/71776***) in view of Gates et al. (***US 20020093075***) with evidence from Ikeda et al. (***US 6407011***) as applied to claim 1 above, and further in view of Martin et al. (***US 6498112***).

10. Venkatraman et al. , Gates et al., and Ikeda et al. disclose the above; however, Venkatraman et al. , Gates et al., and Ikeda et al. are silent to an initial dielectric region.

11. Martin et al. disclose a first dielectric layer disposed on a substrate upon which a graded oxide cap is disposed (***abstract***). The graded oxide cap in combination with the

first dielectric layer allows for improvement at the interface when forming copper or conductive interconnects while reducing the capacitance and RC delays (***col. 3, lines 16+; col. 8, lines 31+***).

All of the elements were known within the art. The only difference is a single disclosure containing all of the presently claimed elements. Venkatraman et al. , Gates et al., and Ikeda et al. disclose the above; however, Venkatraman et al. , Gates et al., and Ikeda et al. are silent to an initial dielectric region. Martin et al. disclose a first dielectric layer disposed on a substrate upon which a graded oxide cap is disposed. The motivation to combine the above elements is drawn towards Martin et al. which disclose such a structure allows for improvement at the interface when forming copper or conductive interconnects while reducing the capacitance and RC delays. Thus, it would have been obvious to place a first dielectric region upon which a graded oxide is disposed to improve interface and electrical properties.

Response to Arguments

12. Applicant's arguments filed 4/6/2010 have been fully considered but they are not persuasive. Applicant asserts that the Examiner has stated the increasing carbon content would lead to an increase in dielectric constant. Examiner respectfully disagrees and based upon the disclosure of Gates as the surface of the layer (i.e. the top of the layer) with having the lowest amount of carbon (i.e. highest dielectric constant) increasing in carbon content towards the bottom of the layer (i.e. lowest dielectric constant), the disclosure of Gates with evidence from Ikeda shows the

dielectric constant increasing with increasing distance from the bottom of the surface to the top. Therefore, as the carbon content increases from the top of the surface to the bottom, the dielectric constant is taken as decreasing from the top to the bottom. Given that the present claims are drawn towards a second layer increasing dielectric constant as the distance from the substrate increases and Gates discloses a second layer having the same, the disclosure of Gates meets the present limitations. Applicant further asserts that the present invention is drawn to two gradient regions not varying in carbon content. Examiner notes that the such a limitation is not found in the present claims nor is it excluded within the specification. As such, the rejections are maintained. Applicant further asserts that claims 10-11 and 17 are not formally rejected. It is noted that the claims were responded to within the body of the rejection but not placed within the initial statement (***Please see paragraph 3 and 4 of previous rejection dated 1/6/2010***). As such, the rejections are maintained.

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PRASHANT J. KHATRI whose telephone number is (571)270-3470. The examiner can normally be reached on M-F 8:00 A.M.-5:00 P.M. (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Sample can be reached on (571) 272-1376. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David R. Sample/
Supervisory Patent Examiner, Art Unit 1783

PRASHANT J KHATRI
Examiner
Art Unit 1783